

The frequency table below shows the results after 30 trials of a simulation. In this situation, a hockey goalie saves 80% of the shots on goal.

Frequency Table: 42 Shots on Goal

<i>Number of Saves</i>	<i>Frequency</i>	
	<i>Individual</i>	<i>Class</i>
27	0	3
28	1	0
29	2	16
30	1	52
31	7	78
32	5	69
33	8	65
34	2	60
35	2	81
36	1	17
37	0	7
38	1	2
<i>Total trials</i>	30	450

Make a prediction about the average number of saves the goalie will make in game if his opponents take 42 shots.

Another Look at Simulations
Warm Up

Name: _____

Date: _____

1. Explain how you could use a 10-sided number cube to simulate the answer to a true or false question.
2. The probability that a soccer player will score a goal is $\frac{2}{5}$. How could random digits be assigned to simulate whether or not the player makes a goal?
3. A student's daily homework average is 70% (7 out of 10 correct). She has a new assignment to turn in.
 - How could you use random digits to simulate the grade on this assignment?
 - A trial would consist of _____ numbers.
 - Based on the simulation below, what is the probability that she gets at least half of her homework problems correct?

1665850687 4293512647 1598981604 7456361773 4843360048

- How many assignments are represented above?
4. A player's batting average is .4. He bats five times per game.
 - How could you use random digits to simulate his times at bat?
 - A trial would consist of _____ numbers.
 - Based on the simulation below, what is the probability that he gets at least 2 hits in five times at bat in a game?

03672	04177	29104	61579	00123
49810	65214	43629	59012	43435

- How many games are represented above?
5. If the probability that an event will occur is $\frac{3}{8}$, what is the probability that the event will not occur?

1. Explain how you could use a 10-sided number cube to simulate the answer to a true or false question.
Half the numbers (odds/evens or 1 to 5/6 to 10) should be assigned to a correct answer, and the other half of the numbers should be assigned to an incorrect answer.
2. The probability that a soccer player will score a goal is $\frac{2}{5}$. How could random digits be assigned to simulate whether or not the player makes a goal?
Using the digits 0–9, you would assign 4 digits to represent the player making a goal. The remaining 6 digits would represent a missed shot.
3. A student's daily homework average is 70% (7 out of 10 correct). She has a new assignment to turn in.
 - How could you use random digits to simulate the grade on this assignment?
Seven digits would be assigned to correct answers. The remaining three digits would represent incorrect answers.
 - A trial would consist of 10 numbers.
 - Based on the simulation below, what is the probability that she gets at least half of her homework problems correct? 100%

1665850687 4293512647 1598981604 7456361773 4843360048

 - How many assignments are represented above? 5 assignments
4. A player's batting average is .4. He bats five times per game.
 - How could you use random digits to simulate his times at bat?
Four digits would be assigned to represent a hit. The remaining 6 digits would represent the player not getting a hit.
 - A trial would consist of 5 numbers.
 - Based on the simulation below, what is the probability that he gets at least 2 hits in five times at bat in a game? 50% - 90%

03672	04177	29104	61579	00123
49810	65214	43629	59012	43435

 - How many games are represented above? 10 games
5. If the probability that an event will occur is $\frac{3}{8}$, what is the probability that the event will not occur? $\frac{5}{8}$

Simulation Reference Sheet

A **Simulation** is a model of a real-life situation in order to predict outcomes. As the number of trials increases, the prediction becomes more accurate.

When designing a simulation, you need to make sure you understand and answer the following questions:

- **What is the problem that we are simulating?**
 - What are the outcomes?
 - What is the probability of each outcome?
 - What are the assumptions?
- **What random device will you use to simulate the problem?**
 - Will I use a coin, spinner, playing cards, number cube, random digit table, or the random number generator?
- **How will you use this random device to simulate the problem?**
 - Coin: What does each side of the coin represent?
 - Spinner: What does each section represent?
 - Playing Cards: What does each color, number, or suit represent?
 - Number Cube: What does each face represent?
 - Random Digit Table: What does each number represent?
 - Random Number Generator: What does each number represent?
- **What does one trial represent to this problem?**
 - What does each flip, or spin, card selection, number cube toss, group of numbers represent?
- **How will you conduct each trial?**
 - Coin: How many times do you need to flip?
 - Spinner: How many times do you need to spin?
 - Playing Cards: How many cards do you need to choose?
 - Dice: How many times do you need to throw?
 - Random Digit Table: How many digits do you need to look at? Where do you start in the table?
 - Random Number Generator: How many digits do you need to look at?
- **How many trials will you conduct?**
 - Will you repeat the process 10, 20, 30 times?
- **What are the results of these trials?**
 - State the specific results of YOUR trial – you should get fraction.
My results show that _____ out of _____ were _____.
- **What predictions can be made based on these results?**
 - This should include your conclusion based on the simulation you conducted.
Based on my results the chances of _____ are _____.

Situation: Sam's Wholesale Club sells a tub of Zany Zoo animal crackers. There are 6 different animal figures (zebra, elephant, monkey, kangaroo, lion and tiger) included in each tub. Design and conduct a simulation of at least 20 trials that can be used to estimate how many handfuls of animal crackers a person needs to take to collect each of the 6 animals if you select a handful of ten animal crackers at a time.

Refer to your Simulation Reference Sheet to design the simulation. Describe how to collect and interpret the data so that you have confidence in the estimation. Write your design in the space below.

Now, perform your simulation.

Trial	Outcomes
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	

What predictions can be made based on the results of the simulation?

Situation: Sam's Wholesale Club sells a tub of Zany Zoo animal crackers. There are 6 different animal figures (zebra, elephant, monkey, kangaroo, lion and tiger) included in each tub. Design and conduct a simulation that will help you calculate the probability of getting each of the six animals if you select a handful of ten animal crackers at a time.

Refer to your Simulation Reference Sheet to design the simulation. Write your design in the space below.

We are simulating taking a handful of ten animal crackers out of the jar and finding out the probability of getting all 6 different animal crackers in the handful.

We have 1 in 6 a chance of getting each figure animal cracker with each cracker pulled out of the jar.

We have to assume that there is an equal amount of each animal included in the jar, so that each animal has an equally likely chance of being chosen.

We will use a random number generator to simulate the problem.

We will use the numbers 1–6. Each number represents a different animal cracker. i.e: 1 = zebra, 2 = elephant, 3 = monkey, 4 = kangaroo, 5 = lion and 6 = tiger We will look at 10 single digits at a time, because we are taking a handful of 10 animal crackers.

Each trial will represent one handful of animal crackers being selected from the jar.

In the random number generator, we will type in RandInt (1,6,10). We will hit enter 20 times to conduct 20 different trials. We will keep track of the number of times that we did collect all 6 numbers in each trial.

To find the probability, we will then need to find:

$$\frac{\text{Total number of times we did collect all 6 animal crackers}}{\text{Total Number of Trials}}$$

Now, perform your simulation.

ANSWERS WILL VARY

Trial	Outcomes
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	

What predictions can be made based on the results of the simulation?

To find the probability, will then need to find:

$$\frac{\text{Total number of times we did collect all 6 animal crackers}}{\text{Total Number of Trials}}$$

According to the simulation, _____ in _____ handfuls of 10 crackers will contain all 6 different animals.

Bel Air High
Simulation #6

Name: _____
Date: _____

Situation: Bel Air High School Football team is to play its rival C. Milton Wright in a three game series. The two teams are evenly matched. Design and conduct a simulation of at least 20 trials that can be used to estimate the likelihood of Bel Air winning the series, in other words, winning at least two of the three games.

Refer to your Simulation Reference Sheet to design the simulation. Describe how to collect and interpret the data so that you have confidence in the estimation. Write your design in the space below.

Now, perform your simulation.

Trial	Outcomes
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	

What predictions can be made based on the results of the simulation?

Situation: Bel Air High School Football team is to play its rival C. Milton Wright in a three game series. The two teams are evenly matched. Design and conduct a simulation of at least 20 trials that can be used to estimate the likelihood of Bel Air winning the series, in other words, winning at least two of the three games.

Refer to your Simulation Reference Sheet to design the simulation. Write your design in the space below.

We are simulating the three game series where Bel Air football team plays C. Milton Wright football team to determine the chances of winning.

Each team has a 50% chance of winning and a 50% chance of losing each game in the three game series.

We are assuming that these odds are still the same and that each team will not have any injuries or other factors that would change their odds.

We will use a random number generator to simulate the situation.

We will use the numbers 1 and 2. 1 = Bel Air wins 2 = Bel Air loses. We will look at 3 digits at a time, because there are three games in the series.

Each trial will represent one three game series.

Using the random number generator, we will type in RandInt (1,2,3) and hit enter 20 times to generate 20 trials. We will keep track of the number of times that Bel Air won the three game series (this would mean that there were at least two 1s in the group of three digits).

To find the probability, we will then need to find:

$$\frac{\text{Total number of times Bel Air won the Series}}{\text{Total Number of Trials}}$$

Now, perform your simulation.

ANSWERS WILL VARY

Trial	Outcomes
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	

What predictions can be made based on the results of the simulation?

To find the probability, will then need to find:

$$\frac{\text{Total number of times Bel Air wins the series}}{\text{Total Number of Trials}}$$

According to the simulation, Bel Air should win the series _____ of the time.

1. Explain how you could use the **spinner** below to simulate whether a person picks a spade out of a deck of 52 cards.

2. Abby scores on $\frac{3}{5}$ of her shots on goal in a field hockey game. Suppose she attempts 8 shots on goal in a game. Explain how you could use a **number cube** to simulate this situation:

3. Explain how you could use **random digits** to simulate guessing on a multiple-choice test where there are 5 choices for each of the 20 questions.

4. Explain a second way you could use **random digits** to simulate guessing on a multiple choice test where there are 5 choices for each of the 20 questions.

5. Given the following simulation, answer the questions that follow.

Situation: Each package of Gooney Gum contains a mystery flavor piece of gum in it. Each of the 6 mystery flavors is equally likely. You purchase 8 packages of Gooney Gum. Find the probability that you get at least 5 different mystery flavors.

Trial	Outcomes
1	6 6 1 5 1 6 6 4
2	1 6 2 4 4 2 6 5
3	5 6 3 1 1 6 2 1
4	6 2 1 2 3 3 2 6
5	3 5 4 4 3 4 2 4
6	5 6 1 1 5 1 1 3
7	2 4 4 6 5 6 2 6
8	3 2 5 4 3 3 1 2
9	1 4 6 4 4 4 2 3
10	4 4 1 2 4 5 3 6

- a. Based on the trials, what do you think they used to simulate the situation?

- b. What does each number represent?

- c. Why did they look at 8 single digits at a time?
- d. Complete the frequency table below based on the trials provided.

Number of Different Mystery Flavors	Frequency
3	
4	
5	
6	

- e. Based on the results in your table, what is the probability that you will get exactly 5 different types of mystery gum?
- f. Based on the results in your table, what is the probability that you will get at least 5 different types of mystery gum?

1. Explain how you could use the **spinner** below to simulate whether a person picks a spade out of a deck of 52 cards.

The spinner would need four equal sections. Designate one section to represent spades and the remaining three sections will represent the remaining three suits. Each time you spin, it will simulate choosing one card.

2. Abby scores on $\frac{3}{5}$ of her shots on goal in a field hockey game. Suppose she attempts 8 shots on goal in a game. Explain how you could use a **number cube** to simulate this situation:

Since there are six numbers on a number cube, designate four of the numbers to represent scores and the remaining two numbers to represent misses. Since she is attempting eight shots, toss the number cube 8 times and record your results.

3. Explain how you could use **random digits** to simulate guessing on a multiple-choice test where there are 5 choices for each of the 20 questions.

Using the numbers 0–9, designate two digits to represent a correct answer and the remaining eight numbers to represent an incorrect answer. i.e. 0,1 = correct answer; 2–9 = incorrect answer. Since there are 20 questions on the test, look at 20 single digits at a time in the table of random numbers and record your results.

4. Explain a second way you could use **random digits** to simulate guessing on a multiple choice test where there are 5 choices for each of the 20 questions.

A Random Number Generator could be used. Input RandInt (0,9,20) into the calculator and hit enter multiple times for multiple trials. Each trial would consist of 20 digits, representing the 20 questions on the multiple-choice test.

5. Given the following simulation, answer the questions that follow.

Situation: Each package of Gooley Gum contains a mystery flavor piece of gum in it. Each of the 6 mystery flavors is equally likely. You purchase 8 packages of Gooley Gum. Find the probability that you get at least 5 different mystery flavors.

Trial	Outcomes
1	6 6 1 5 1 6 6 4
2	1 6 2 4 4 2 6 5
3	5 6 3 1 1 6 2 1
4	6 2 1 2 3 3 2 6
5	3 5 4 4 3 4 2 4
6	5 6 1 1 5 1 1 3
7	2 4 4 6 5 6 2 6
8	3 2 5 4 3 3 1 2
9	1 4 6 4 4 4 2 3
10	4 4 1 2 4 5 3 6

- a. Based on the trials, what do you think they used to simulate the situation?
They used random digits either in a table or the generator on the calculator.
- b. What does each number represent?
Each number represents a different mystery flavor.
- c. Why did they look at 8 single digits at a time?
They are simulating the purchase of eight packages of gum.
- d. Complete the frequency table below based on the trials provided.

Number of Different Mystery Flavors	Frequency
3	0
4	5
5	4
6	1

- e. Based on the results in your table, what is the probability that you will get exactly 5 different types of mystery gum?

$$\frac{4}{10} = \frac{2}{5}$$

- f. Based on the results in your table, what is the probability that you will get at least 5 different types of mystery gum?

$$\frac{5}{10} = \frac{1}{2}$$

Using a statistic from a media source (newspaper, magazine, television or radio news broadcast, or reliable internet source), design a simulation of your own. You should refer to the Simulations Reference Sheet to ensure that you have answered all the questions necessary for a complete design. The following questions must be answered. All simulation designs must be typed.



- **What is the problem that you are simulating?**
- **What random device will you use to simulate the problem?**
- **How will you use this random device to simulate the problem?**
- **What does one trial represent to this problem?**
- **How will you conduct each trial?**
- **How many trials will you conduct?**
- **Describe how to interpret the data so that you have confidence in the estimation.**

Note: You will not conduct any trials. You are only designing the simulation.